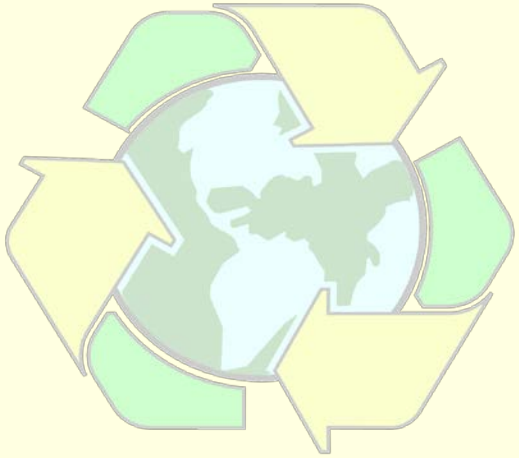
PURDUE
UNIVERSITY

101st Annual Road School

Full Depth Reclamation

REUSE YOUR ROADWAY

Road Rehabilitation Technology



James W. Render Jr.
Business Development
Essroc Cement

Jerry Larson
Executive Director
IRMCA

Windmill Projects - Benton Co. Indiana

- County Road System
  - Built for Farm use
  - Light loads
- 200 fully loaded trucks per Windmill
- Road system failure
  - Job delays
  - RM truck breakdowns
  - Dozers on site to pull trucks in & out
  - Disaster & dissatisfaction for residents

Before FDR Process

After FDR Process

Lessons Learned

- FDR / SCS Process was competitive with conventional road building process with stone.
- FDR / SCS Process held up under tremendous loading
- Gave the taxpaying farmers & residents access to their land during the construction sequence
- Why couldn’t you use this process on conventional county road systems

Current Situation

- County / municipality road systems already in place
- Emphasis on maintenance / rehabilitation
- These roads are local, low-volume, either flexible pavements or unpaved (gravel)
- As asphalt prices continue to escalate the old tired solutions are becoming cost prohibitive

Tight times put gravel on the road

Gravel roads, once a symbol of quaint times, are emerging as a sign of financial struggle in a growing number of rural towns.

High costs and tight budgets have prompted communities in Maine, Michigan, Indiana, Pennsylvania and Vermont to convert or consider converting their cracked asphalt roads back to gravel to cut maintenance costs, officials in those states say.

ALTERNATIVES???

- Fix the potholes & resurface with asphalt, again & again & again
- Reclamation with aggregate, again & again & again
- Dig it up & start again

ALTERNATIVES???

- Fix the potholes & resurface with asphalt, again & again & again
- Reclamation with aggregate, again & again & again
- Dig it up & start again
  - Excavation
  - Fill with #2's
  - Add DGA
  - Chip Seal

NEW ALTERNATIVE!

FIX IT RIGHT THE FIRST TIME !!!

- Full Depth Reclamation with cement
- Green solution – In place recycling
- Long term solution for short term money
- Surface of Asphalt or chip seal

Full Depth Reclamation

A New Solution

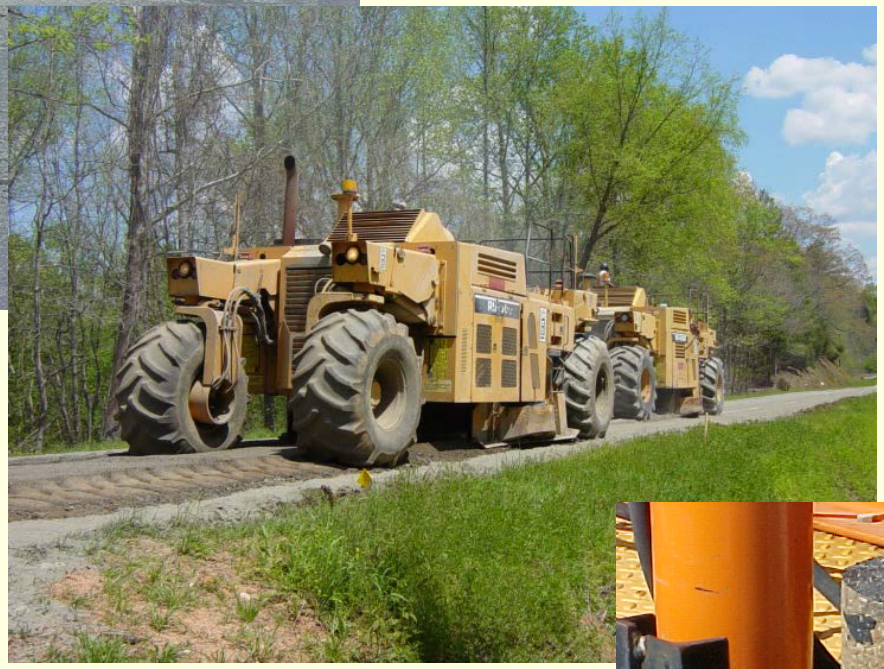
for

Changing Times

FDR with Cement

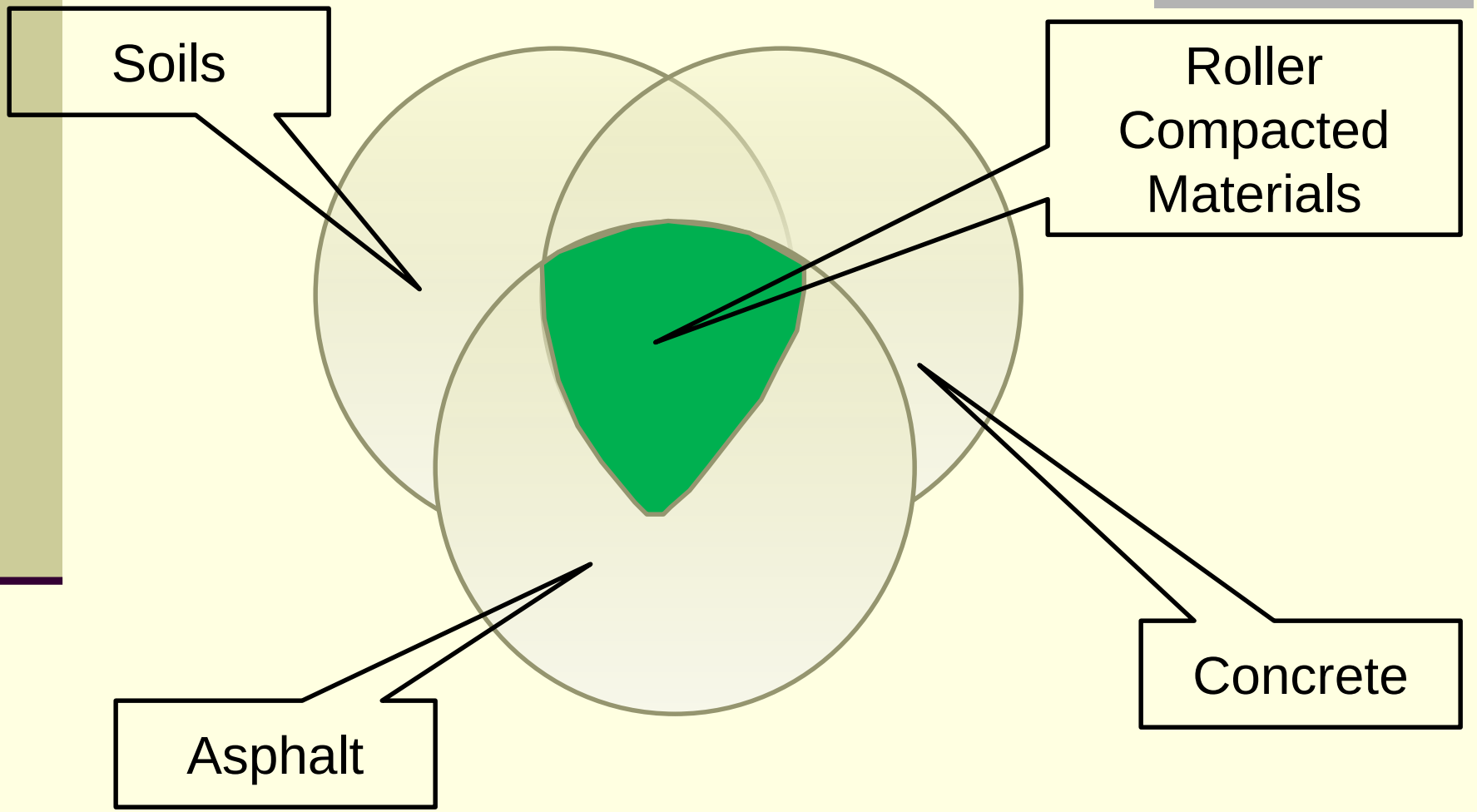
- **Full Depth Reclamation Using Cement** is a method of pavement reconstruction that utilizes the existing asphalt, base, and subgrade material to produce a new stabilized base course.

Reuse Your Roadway!



Create a Cement Stabilized Base to carry the loads

Three Worlds Coming Together



Why Portland Cement???

“Portland Cement is probably the closest thing we have to a universal stabilizer.”

From U.S. Army Corps of Engineers report “Chemical Stabilization Technology for Cold Weather”, Sept. 2002

Cement Stabilization History

- 70 years of successful pavements
- Diverse geographic areas (Texas, Florida, California, Montana, Michigan, Canada)
- Wide variety of soil types
  - Gravels
  - Sands
  - Silts
  - Clays
- Portland Cement gives significantly better strength than LKD

Conventional FDR Construction Sequence

FDR Construction Sequence

- Spreading
- Pulverization
- Mixing
- Initial Compaction
- Grading
- Final Compaction
- Curing
- Surfacing

Bulk Transfer

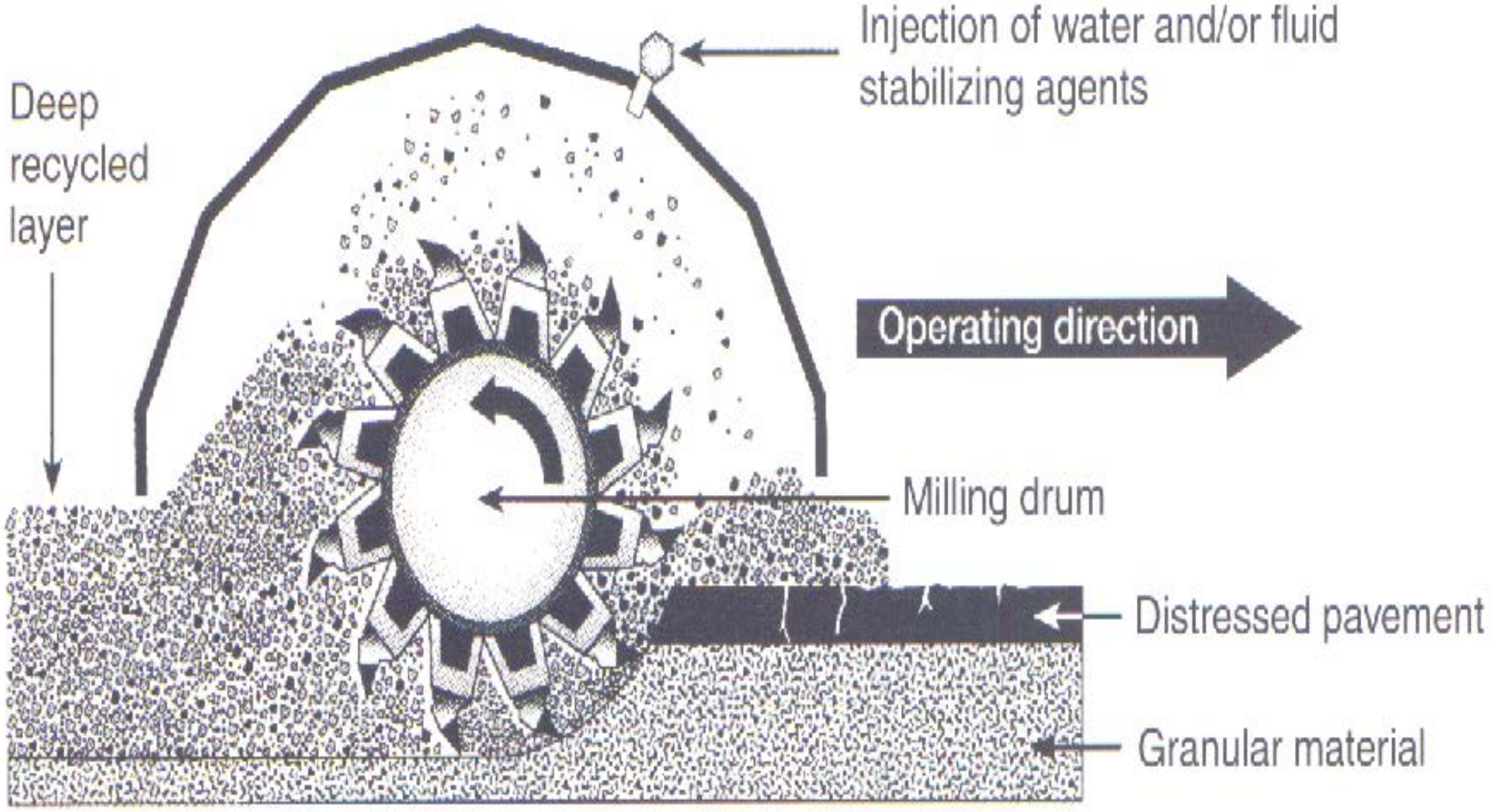
Spreading Dry Cement


SC4213

Dry Mixing

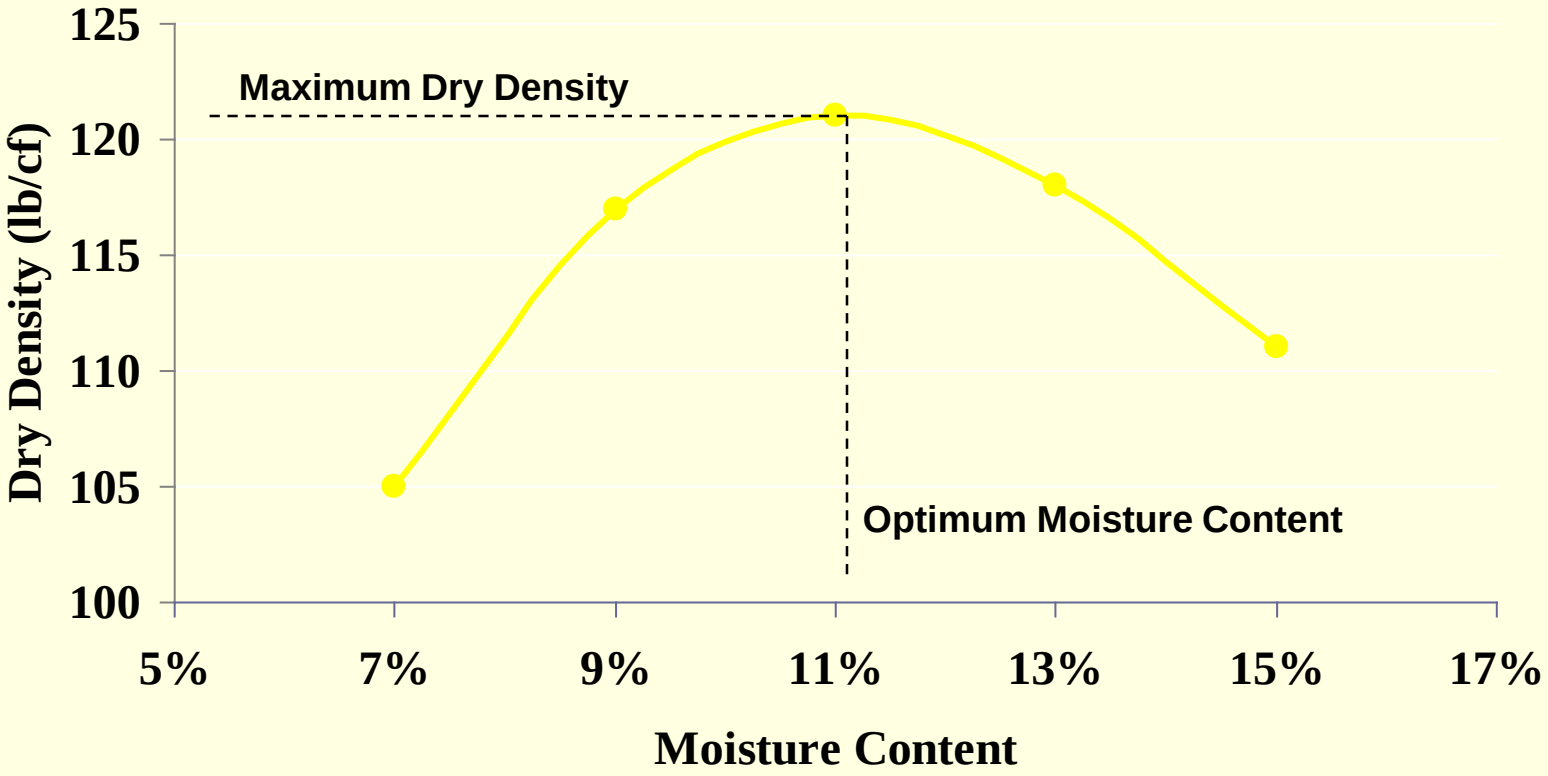

Pulverization

Inside a Reclaimer



Gradation

Moisture/Density Relationship



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Wet Mixing

Optimum Moisture Content


WR 2500 S
Wirtgen
SC2265

Initial Compaction

Grading

Final Compaction


SL0012

Curing

Basic Premise

- We are making a lean concrete out of the existing road base.
- By utilizing the existing material, we don't significantly change the road elevation, allowing ditch line integrity to be maintained
- Although this material can NOT be used as a road surface, it allows a chip seal, slurry seal or other thin flexible pavement to last far beyond normal expectations

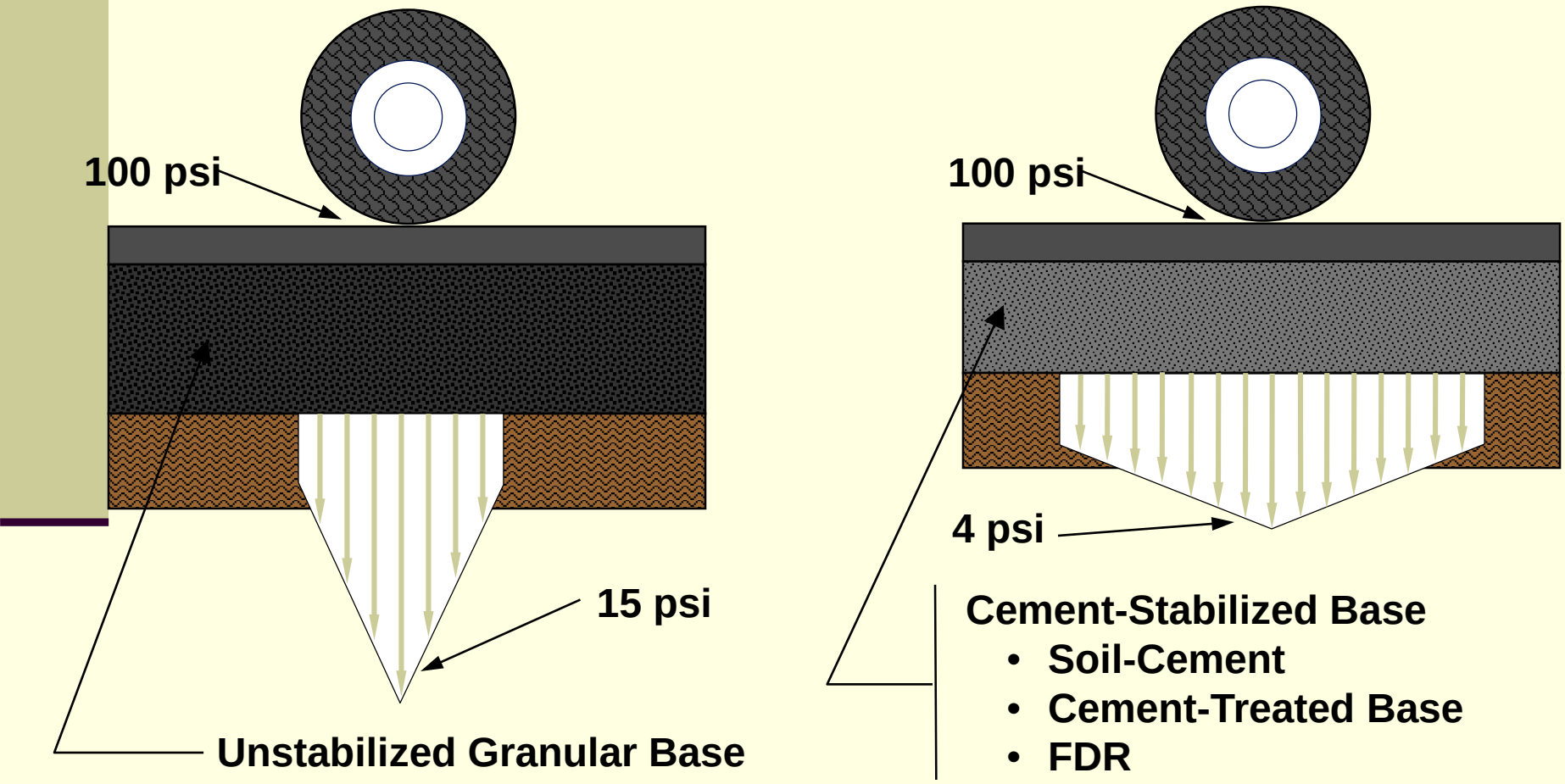
Resurfacing

Surfacing

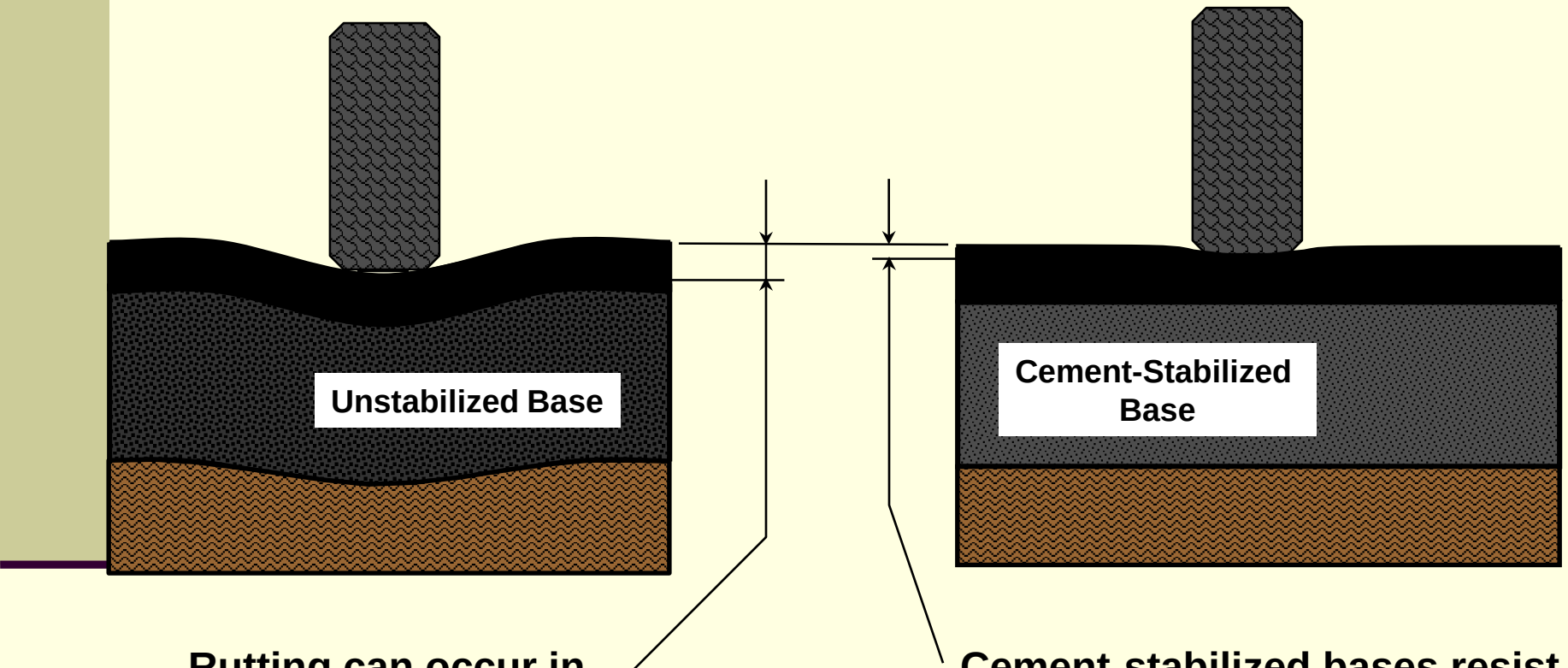
FDR

Design Advantages
&
Engineering Properties

Increased Rigidity Spreads Loads



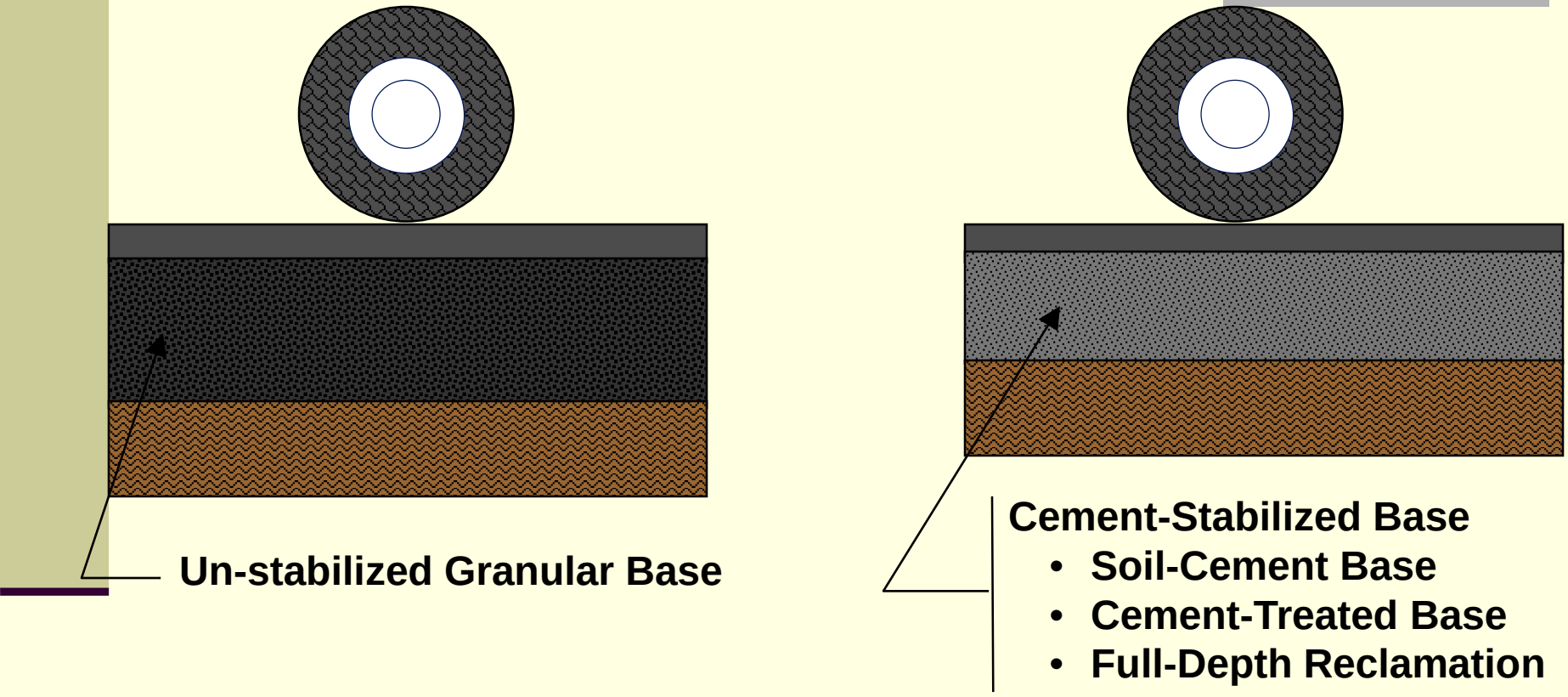
Eliminates Rutting Below Surface



Rutting can occur in surface, base and subgrade of un-stabilized bases due to repeated wheel loading

Cement-stabilized bases resist consolidation and movement, thus virtually eliminating rutting in all layers but the asphalt surface.

Thinner Pavement Section



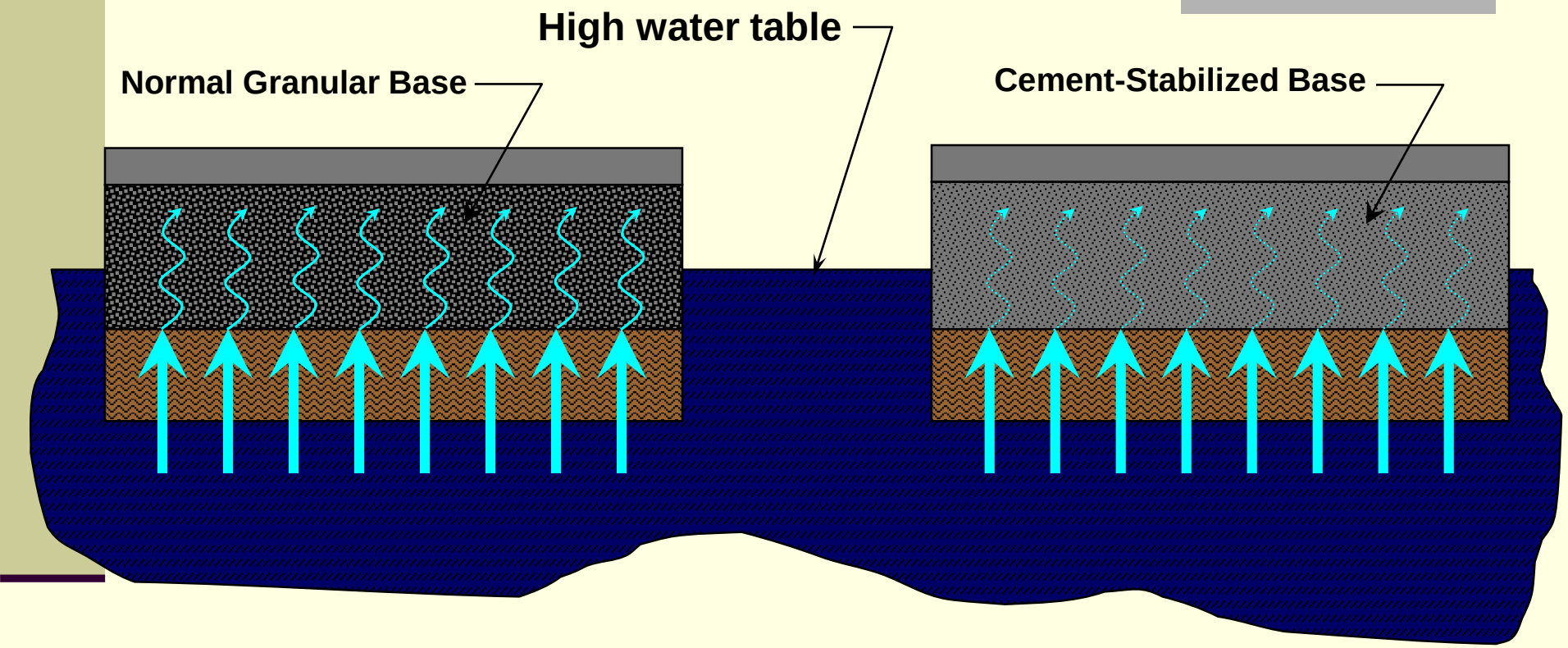
Un-stabilized Granular Base

Cement-Stabilized Base

- Soil-Cement Base
- Cement-Treated Base
- Full-Depth Reclamation

Accepted Rule-of-Thumb:
8 inches of a crushed stone base is equal to
6 inches of a FDR base stabilized with cement

Reduced Moisture Susceptibility



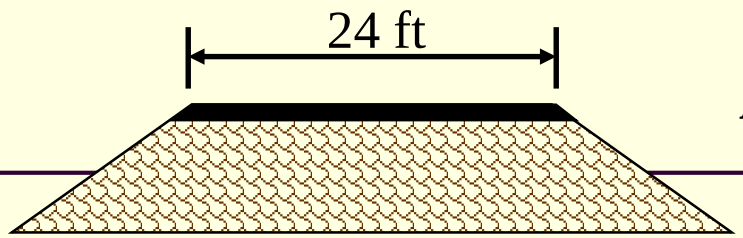
Moisture infiltrates base

- Through high water table
- Capillary action
- Causing softening, lower strength, and reduced modulus

Cement stabilization:

- Reduces permeability
- Helps keep moisture out
- Maintains high level of strength and stiffness even when saturated

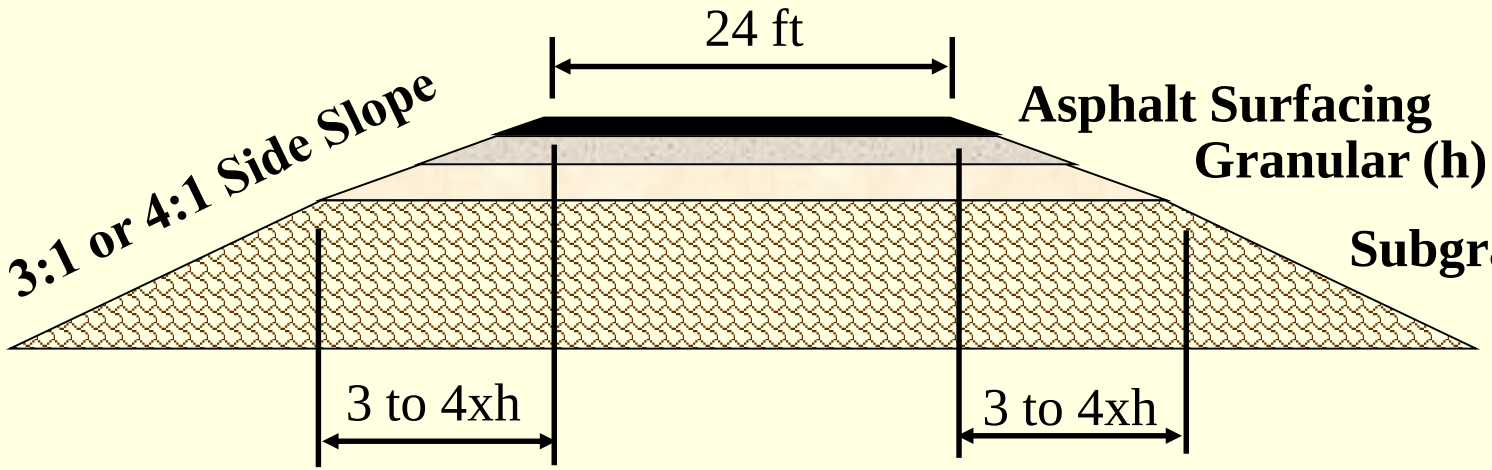
Existing Thin Paved Structure



Asphalt Surfacing

Subgrade

Conventional Build Up Granular Structure

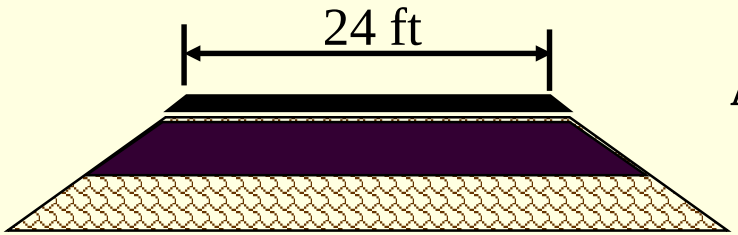


Asphalt Surfacing

Granular (h)

Subgrade

Full-Depth Recycled Structure



Asphalt Surfacing

Stabilized Base

Subgrade

Widening

- Best Practice
- Mixing chamber assures blending of aggregate from the road base to the sub base material in the lane widened area.
- This thorough mixing is the most efficient way of creating a contiguous base that will perform.
- No more failure on the widened lane joint.

Widening Example

Mix Design

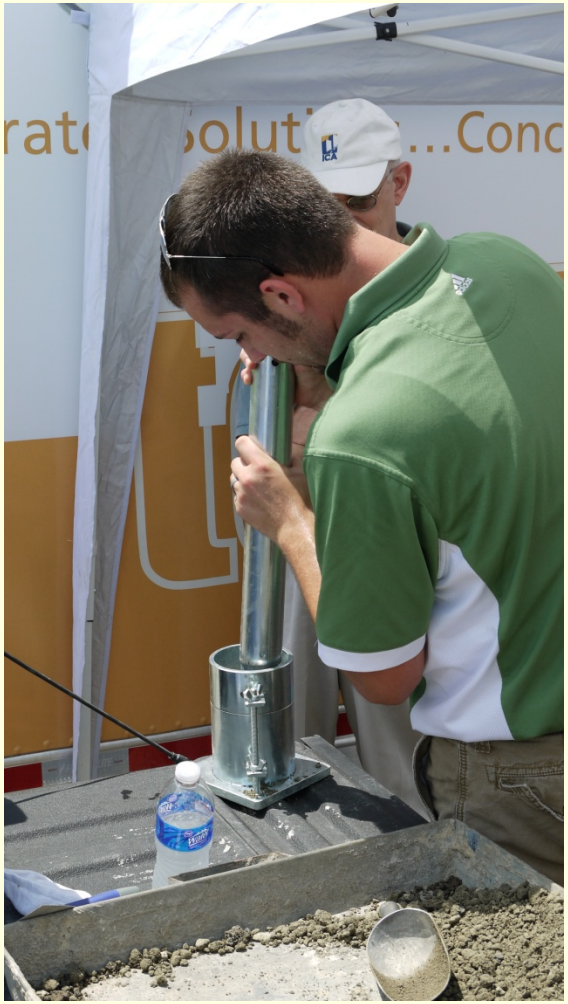
- Just as in Ready Mix Concrete or Roller Compacted Concrete, a material evaluation is necessary to determine properties of FDR
  - Cement Content – Spread Rate
  - Optimum Moisture Content
  - Compaction
  - Target Strength

Trial Batches

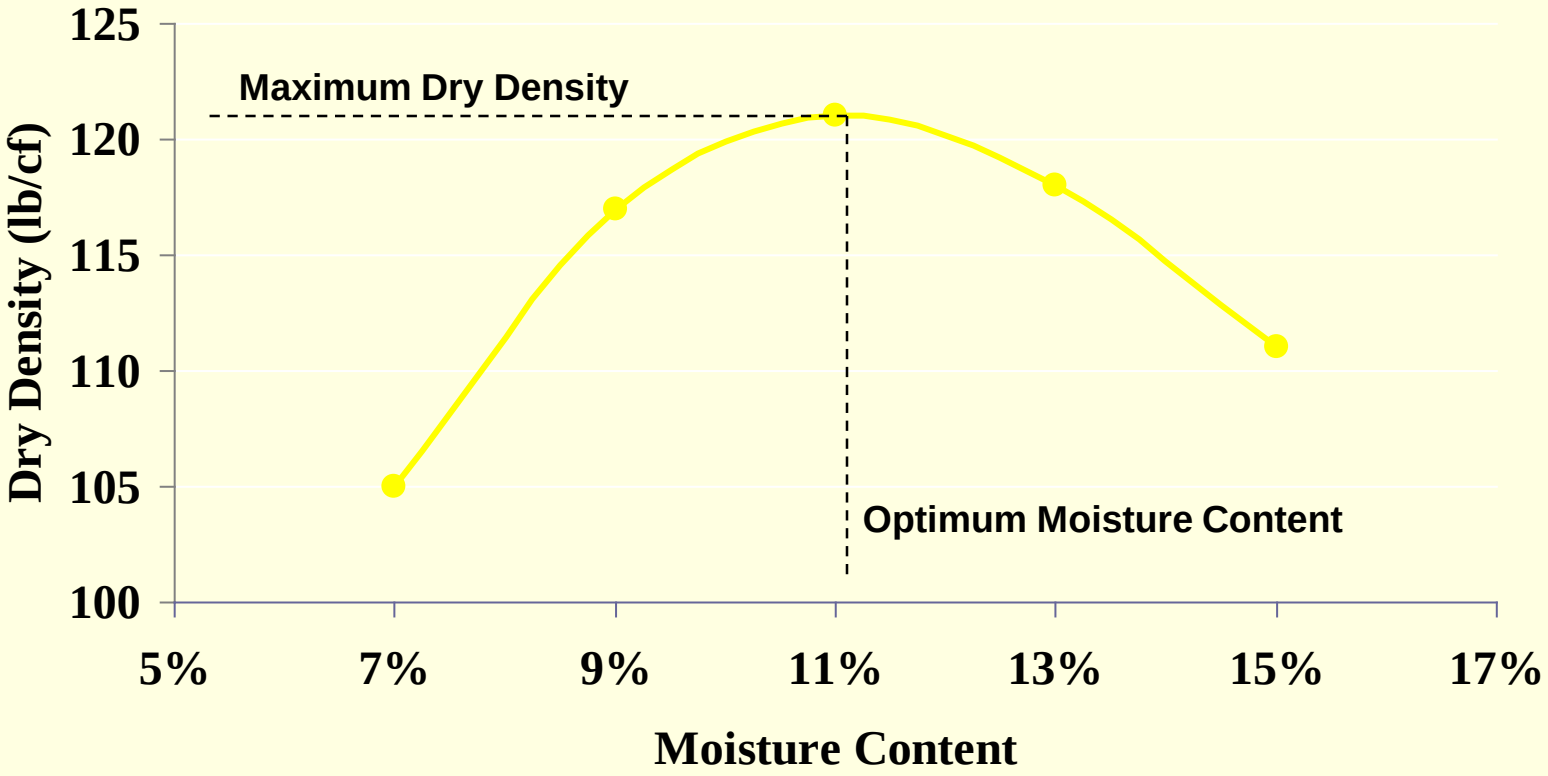
- Typically any new project has trial batches made from the material
- Modified Procter is run to determine optimum moisture content & spread rate.
- The finer the material, the higher the “Spread Rate”

Determining Spread Rate

- In the dry process your mix design sets a spread rate typically between 4 – 8% cement by weight.
- This would be determined in the field by laying a square foot canvas cloth on the surface & driving the spreader over the cloth, picking it up & weighing the dry cement.



Moisture/Density Relationship



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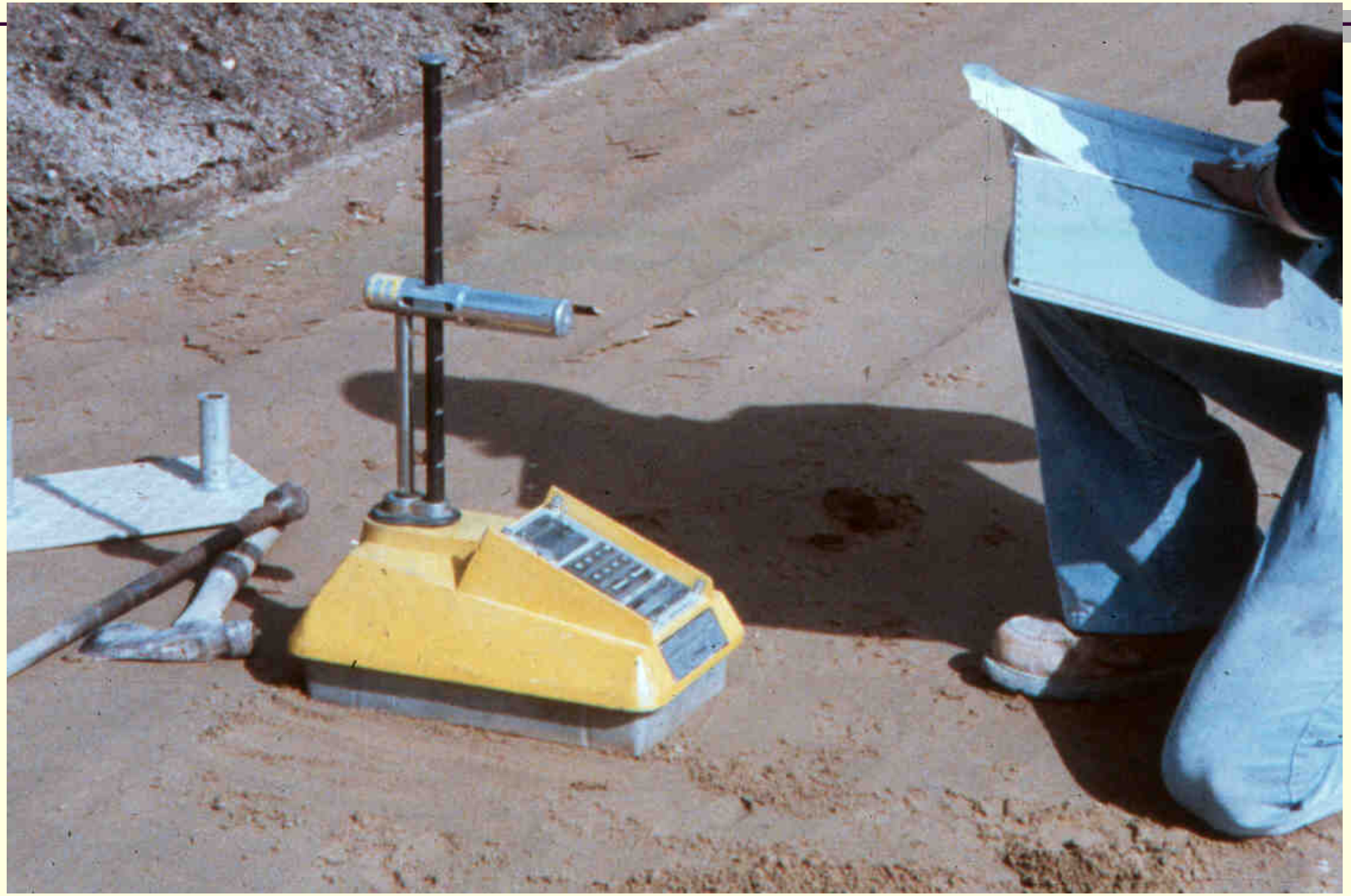
Field Testing - Moisture

Nuclear Density Testing



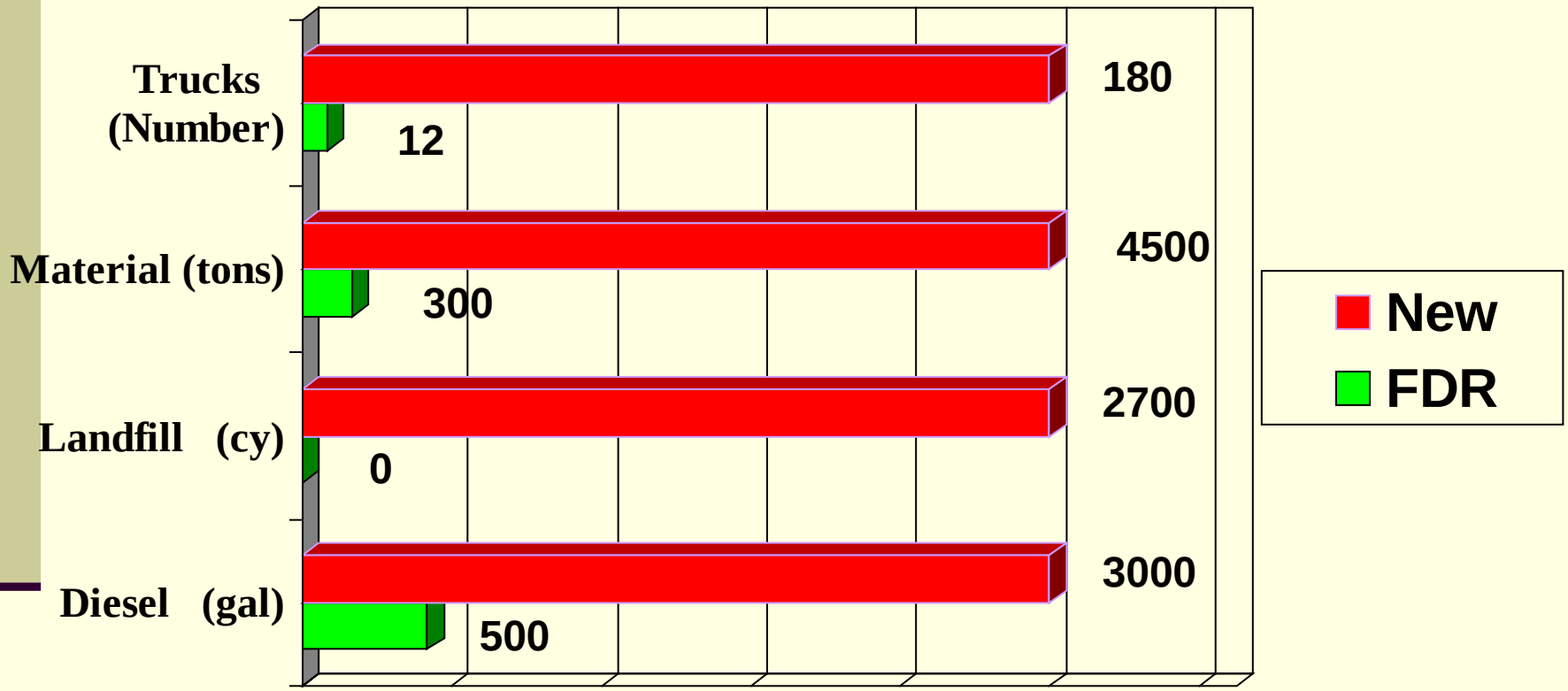
FDR

Green Advantages

Environmental Advantages

- Use of in-place materials
- Little or no material hauled off and dumped
- Maintains or improves existing grade
- Conserves virgin material
- Saves cost by using in-place "investment"
- Saves energy by reducing mining and hauls

Reclamation-versus-New Base



1 Mile of 24'-wide 2-lane road,
6" base + 2" asphalt surface

How can I use my own forces to rebuild roads with FDR with Cement???

RM FDR

Ready Mixed Full Depth Reclamation

The County Model

Grout Calculator

Indiana County Market

- Several Counties have now used FDR
  - Cass County
  - Union County
  - Henry County
  - Putnam County
  - Daviess County
    - Did 30 miles of traditional FDR in the 90’s with great success
    - Roadways still in use with very little maintenance

The History FDR in Indiana

- Dry spread
- Wet Mix
- RM Heavy Grout
- RM Slurry
- RM Drag Box Grout

Henry County


61

Benton County


RAIL ROAD CROSSING
2
TRACKS
STOP
DIVIDED HIGHWAY
ONE WAY

Putnam County


BUILDER'S CONCRETE – PROVIDING


BOMAG
BOMAG RECYCLER

Drag Box Grout


STONE CONCRETE
#356923


NRMCA
NEW HOLLAND
DANGER
STAY CLEAR
OF CHUTE
1662
LANDPRIDE


BOMAG

Union County


03/10/2011 20:48


03/09/2011 14:29


BOMAG
BOMAG
FAYAT GROUP
03/10/2011 13:54

Cass County Indiana RM FDR

- Initial plan was to overlay an existing road with 7” of asphalt.
- Working with IRMCA they came up with a value engineering proposal to FDR the existing chip sealed road with 10” deep FDR and double chip seal the roadway.
- Cass County had their own Mixer.
- The savings allowed them to add another project to their slate this season.

Roadway was mixed

Windrowed with a grader

Slurry addition

Remixed & Regraded


CATERPILLAR


TEREX
RS44


TEREX

Questions????

Thank You!!!